

## Implementation Techniques for Non-Symmetric Real Toeplitz Systems by Preconditioned GMRES Method

We study the case where the generating function  $f$ , of the Toeplitz system, is not known a priori.

- 1 Approximate the “shape” of the function  $f$ .
  - Fourier expansion
  - Rayleigh quotient
- 2 Estimate the roots of  $f$ .
- 3 Estimate the multiplicity of the roots.
- 4 Select the appropriate trigonometric polynomial  $g$ , that eliminates the (estimated) roots of  $f$ .
- 5 Approximate the function  $\frac{f}{g}$ , using best uniform approximation by a trigonometric polynomial  $q$ .
- 6 Construct the band Toeplitz preconditioner  $T_n(p)$ , where  $p = gq$ .
- 7 Solve the linear system  $T_n x = b$ , by PGMRES.